

What Is Claimed Is:

1. A decision support system for evaluating supportability of alternative system architecture designs comprising:

an analytic hierarchy process (AHP) model comprising a plurality of attributes, wherein said plurality of attributes comprises:

- a commonality attribute;
- a modularity sub-attribute;
- a standards based sub-attribute; and
- a reliability, maintainability, testability (RMT) sub-attribute.

2. The system of claim 1, wherein said commonality attribute comprises:

a plurality of sub-attributes of said commonality attribute, said plurality of sub-attributes of said commonality attribute comprising at least one of:

- a physical commonality sub-attribute;
- a physical familiarity sub-attribute; and
- an operational commonality sub-attribute.

3. The system of claim 2, wherein said physical commonality sub-attribute further comprises:

a plurality of sub-attributes of said physical commonality sub-attribute, said plurality of sub-attributes of said physical commonality sub-attribute comprising at least one of:

- a hardware (HW) commonality sub-attribute; and

a software (SW) commonality sub-attribute.

4. The system of claim 3, wherein said hardware commonality sub-attribute comprises:

a plurality of sub-attributes of said hardware commonality sub-attribute,
said plurality of sub-attributes of said hardware commonality sub-attribute
comprising at least one of:

a number of unique lowest replaceable units (LRUs)
sub-attribute;
a number of unique fasteners sub-attribute;
a number of unique cables sub-attribute; and
a number of unique standards Implemented sub-
attribute.

5. The system of claim 3, wherein said software commonality sub-attribute comprises:

a plurality of sub-attributes of said software commonality sub-attribute, said
plurality of sub-attributes of said software commonality sub-attribute comprising at least
one of:

a number of unique SW packages implemented
sub-attribute;
a number of languages sub-attribute;
a number of compilers sub-attribute;
a average number of SW instantiations sub-
attribute; and

a number of unique standards implemented sub-attribute.

6. The system of claim 2, wherein said physical familiarity sub-attribute comprises:

a plurality of sub-attributes of said physical familiarity sub-attribute, said plurality of sub-attributes of said physical familiarity sub-attribute comprising at least one of:

a percentage vendors known sub-attribute;
a percentage subcontractors known sub-attribute;
a percentage HW technology known sub-attribute; and
a percentage SW technology known sub-attribute.

7. The system of claim 2, wherein said operational commonality sub-attribute comprises:

a plurality of sub-attributes of said operational commonality sub-attribute, said plurality of sub-attributes of said operational commonality sub-attribute comprising at least one of:

a percentage of operational functions automated sub-attribute;
a number of unique skill codes required sub-attribute;
an estimated operational training time - initial sub-attribute;
an estimated operational training time - refresh from previous system sub-attribute;
an estimated maintenance training time - initial sub-

attribute; and

an estimated maintenance training time - refresh from
previous system sub-attribute.

8. The system of claim 1, wherein said modularity attribute comprises:

a plurality of sub-attributes of said modularity attribute, said plurality of
sub-attributes of said modularity attribute comprising at least one of:

a physical modularity sub-attribute;

a functional modularity sub-attribute;

an orthogonality sub-attribute;

an abstraction sub-attribute; and

an interfaces sub-attribute.

9. The system of claim 8, wherein said physical modularity sub-attribute comprises:

a plurality of sub-attributes of said physical modularity sub-attribute, said
plurality of sub-attributes of said physical modularity sub-attribute comprising at
least one of:

an ease of system element upgrade sub-attribute; and

an ease of operating system element upgrade sub-attribute.

10. The system of claim 9, wherein said ease of system element upgrade sub-attribute
comprises:

a plurality of sub-attributes of said ease of system element upgrade sub-

attribute, said plurality of sub-attributes of said ease of system element upgrade sub-attribute comprising at least one of:

a lines of modified code sub-attribute; and

an amount of labor hours for system rework sub-attribute.

11. The system of claim 9, wherein said ease of operating system element upgrade sub-attribute comprises:

a plurality of sub-attributes of said ease of operating system element upgrade sub-attribute, said plurality of sub-attributes of said ease of operating system element upgrade sub-attribute comprising at least one of:

a lines of modified code sub-attribute; and

an amount of labor hours for system rework sub-attribute.

12. The system of claim 8, wherein said functional modularity sub-attribute further comprises:

a plurality of sub-attributes of said functional modularity sub-attribute, said plurality of sub-attributes of said functional modularity sub-attribute comprising at least one of:

an ease of adding new functionality sub-attribute; and

an ease of upgrade existing functionality sub-attribute.

13. The system of claim 12, wherein said ease of adding new functionality sub-attribute further comprises:

a plurality of sub-attributes of said ease of adding new functionality sub-attribute, said plurality of sub-attributes of said ease of adding new functionality sub-attribute comprising at least one of:

a lines of modified code sub-attribute; and

an amount of labor hours for system rework sub-attribute.

14. The system of claim 12, wherein said ease of upgrading existing functionality sub-attribute, said plurality of sub-attributes comprises:

a plurality of sub-attributes of said ease of upgrading existing functionality sub-attribute, said plurality of sub-attributes of said ease of upgrading existing functionality sub-attribute comprising at least one of:

a lines of modified code sub-attribute; and

an amount of labor hours for system rework sub-attribute.

15. The system of claim 8, wherein said orthogonality sub-attribute comprises:

a plurality of sub-attributes of said orthogonality sub-attribute, said plurality of sub-attributes of said orthogonality sub-attribute comprising at least one of:

a determination of whether functional requirements are

fragmented across multiple processing elements and interfaces
sub-attribute;

a determination of whether there are throughput
requirements across interfaces sub-attribute; and

a determination of whether common specifications are
identified sub-attribute.

16. The system of claim 8, wherein said abstraction sub-attribute comprises:

a plurality of sub-attributes of said abstraction sub-attribute, said plurality of sub-
attributes of said abstraction sub-attribute comprising:

a determination of whether the system architecture provides
an option for information hiding sub-attribute.

17. The system of claim 8, wherein said interfaces sub-attribute comprises:

a plurality of sub-attributes of said interfaces sub-attribute, said plurality of sub-
attributes of said interfaces sub-attribute comprising at least one of:

a number of unique interfaces per system element sub-
attribute;

a number of different networking protocols sub-attribute;

an explicit versus implicit interfaces sub-attribute;

a determination of whether the architecture involves
implicit interfaces sub-attribute; and

a number of cables in the system sub-attribute.

18. The system of claim 1, wherein said AHP structure further comprises:

a plurality of sub-attributes of said standards based attribute, said plurality of sub-attributes of said standards based attribute comprising at least one of:

an open systems orientation sub-attribute; and

a consistency orientation sub-attribute.

19. The system of claim 18, wherein said open systems orientation sub-attribute comprises:

a plurality of sub-attributes of said open systems orientation sub-attribute, said plurality of sub-attributes of said open systems orientation sub-attribute comprising at least one of:

an interface standards sub-attribute;

a HW standards sub-attribute; and

a software standards sub-attribute.

20. The system of claim 19, wherein said interface standards sub-attribute comprises:

a plurality of sub-attributes of said interface standards sub-attribute, said plurality of sub-attributes of said interface standards sub-attribute comprising at least one of:

a number of interface standards/number and number of Interfaces sub-attribute;

a determination of multiple vendors (greater than 5) existing for products based on standards sub-attribute;

a multiple business domains apply/use standard
(Aerospace, Medical, Telecommunications) sub-attribute;
and
a standard maturity sub-attribute.

21. The system of claim 19, wherein said hardware standards sub-attribute comprises:

a plurality of sub-attributes of said hardware standards sub-attribute, said plurality
of sub-attributes of said hardware standards sub-attribute comprising at least one of:

a number of form factors and number of LRUs sub-
attribute;

a multiple vendors (greater than 5) exist for a
products based on standards sub-attribute;

a multiple business domains apply/use standard
(aerospace, medical, telecommunications) sub-attribute;
and

a standard maturity sub-attribute.

22. The system of claim 19, wherein said software standards sub-attribute comprises:

a plurality of sub-attributes of said software standards sub-attribute, said plurality
of sub-attributes of said software standards sub-attribute comprising at least one of:

a number of proprietary & unique operating systems
sub-attribute;

a number of non-std databases sub-attribute;

a number of proprietary middle-ware sub-attribute;

and

a number of non-std languages sub-attribute.

23. The system of claim 18, wherein said consistency orientation sub-attribute comprises:

a plurality of sub-attributes of said consistency orientation sub-attribute, said plurality of sub-attributes of said consistency orientation sub-attribute comprising at least one of:

common guidelines for implementing diagnostics and performance monitoring/fault localization (PM/FL) sub-attribute; and

common guidelines for implementing operator machine interface (OMI) sub-attribute.

24. The system of claim 1, wherein said RMT attribute comprises:

a plurality of sub-attributes of said RMT attribute, said plurality of sub-attributes of said RMT attribute comprising at least one of:

a reliability sub-attribute;

a maintainability sub-attribute; and

a testability sub-attribute.

25. The system of claim 24, wherein said reliability sub-attribute comprises:

a plurality of sub-attributes of said reliability sub-attribute, said plurality of sub-

attributes of said reliability sub-attribute comprising at least one of:

a fault tolerance sub-attribute; and

a critical points of delicateness (system loading) sub-attribute.

26. The system of claim 25 wherein said fault tolerance sub-attribute comprises:

a plurality of sub-attributes of said fault tolerance sub-attribute, said plurality of sub-attributes of said fault tolerance sub-attribute comprising at least one of:

a percentage of mission critical functions with single points of failure sub-attribute; and

a percentage of safety critical functions with single points of failure sub-attribute.

27. The system of claim 25 wherein said critical points of delicateness (system loading) sub-attribute further comprises:

a plurality of sub-attributes of said critical points of delicateness (system loading) sub-attribute, said plurality of sub-attributes of said critical points of delicateness (system loading) sub-attribute comprising at least one of:

a percentage of processor loading sub-attribute;

a percentage of memory loading sub-attribute; and

a percentage of network loading sub-attribute.

28. The system of claim 27 wherein said percentage memory loading sub-attribute comprises

a criticality assessment sub-attribute of said percentage memory loading sub-attribute.

29. The system of claim 27 wherein said percentage network loading sub-attribute comprises a criticality assessment sub-attribute of said percentage network loading sub-attribute.

30. The system of claim 24, wherein said maintainability sub-attribute comprises:
a plurality of sub-attributes of said maintainability sub-attribute, said plurality of sub-attributes of said maintainability sub-attribute comprising at least one of:

an expected MTTR sub-attribute;

a maximum fault group size sub-attribute;

a determination of whether system is operational during maintenance sub-attribute; and

an accessibility sub-attribute.

31. The system of claim 30, wherein said accessibility sub-attribute further comprises:
a plurality of sub-attributes of said accessibility sub-attribute, said plurality of sub-attributes of said accessibility sub-attribute comprising at least one of:

a space restrictions determination sub-attribute;

a special tool requirements determination sub-attribute; and

a special skill requirements determination sub-attribute.

32. The system of claim 24, wherein said testability sub-attribute comprises:

a plurality of sub-attributes of said testability sub-attribute, said plurality of sub-attributes of said testability sub-attribute comprising at least one of:

a BIT Coverage sub-attribute;

an error reproducibility sub-attribute;

an online testing sub-attribute; and

an automated input/stimulation insertion sub-attribute.

33. The system of claim 32 wherein said error reproducibility sub-attribute comprises:

a plurality of sub-attributes of said error reproducibility sub-attribute, said plurality of sub-attributes of said error reproducibility sub-attribute comprising at least one of:

a logging/recording capability sub-attribute; and

a determination of whether system state at time of system failure can be created sub-attribute.

34. The system of claim 32 wherein said online testing sub-attribute comprises:

a plurality of sub-attributes of said online testing sub-attribute, said plurality of sub-attributes of said online testing sub-attribute comprising at least one of:

a determination of whether system is operational

during external testing sub-attribute; and

an ease of access to external testpoints sub-

attribute.

35. A decision support system for evaluating the supportability of alternative system architecture designs comprising:

means for assigning relative weights to each attribute and sub-attribute of a plurality of attributes and sub-attributes of an analytical hierarchy process (AHP) model wherein said plurality of attributes comprises:

a commonality attribute,

a modularity attribute,

a standards based attribute, and

a reliability, maintainability, and testability (RMT) attribute,

comprising:

means for performing pair-wise comparisons of said plurality of attributes and sub-attributes at all levels of said AHP model, and

means for assigning relative weights to all of said attributes and sub-attributes at all levels of said AHP model;

means for generating a GPW for each of a plurality of alternative system architecture designs comprising:

means for performing pair-wise comparisons of each of said plurality of alternative system architecture designs with respect to said all of said attributes and sub-attributes at all levels of said AHP model; and

means for evaluating said plurality of alternative system architecture designs from a supportability perspective comprising comparing values of said GPWs of said plurality of alternative system architecture designs.

36. A decision support system that determines global priority weights (GPWs) of alternative system architecture designs comprising:

an analytic hierarchy process engine

operative to compare a plurality of relative priority attribute weights to generate the GPW of each of the alternative system architecture designs wherein the relative priority attribute weights correspond to a plurality of attributes; and

operative to compare a plurality of relative priority sub-attribute weights to generate each of said plurality of relative priority attribute weights wherein the relative priority sub-attribute weights correspond to a plurality of sub-attributes;

wherein said plurality of attributes comprises

a commonality attribute;

a modularity attribute;

a standards based attribute; and

a reliability, maintainability, and testability (RMT) attribute.

37. A method for evaluating the supportability of alternative system architecture designs comprising the steps of:

(a) assigning relative weights to each attribute and sub-attribute of a plurality of attributes and sub-attributes of an analytical hierarchy process (AHP) model wherein said plurality of attributes comprises:

a commonality attribute,

a modularity attribute,

a standards based attribute, and

a reliability, maintainability, and testability (RMT) attribute,

comprising:

- (1) performing pair-wise comparisons of said plurality of attributes and sub-attributes at all levels of said AHP model, and
 - (2) assigning relative weights to all of said attributes and sub-attributes at all levels of said AHP model;
- (b) generating a GPW for each of a plurality of alternative system architecture

designs comprising:

- (1) performing pair-wise comparisons of each of said plurality of alternative system architecture designs with respect to said all of said attributes and sub-attributes at all levels of said AHP model; and
- (c) evaluating said plurality of alternative system architecture designs from a supportability perspective comprising comparing values of said GPWs of said plurality of alternative system architecture designs.

38. The method of claim 37, wherein said commonality attribute comprises:

a plurality of sub-attributes comprising at least one of:

- a physical commonality sub-attribute;
- a physical familiarity sub-attribute; and
- an operational commonality sub-attribute.

39. The method of claim 38, wherein said physical commonality sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

- a hardware (HW) commonality sub-attribute; and

a software (SW) commonality sub-attribute.

40. The method of claim 39, wherein said hardware commonality sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

a number of unique logical replacement units
(LRUs) sub-attribute;
a number of unique fasteners sub-attribute;
a number of unique cables sub-attribute; and
a number of unique standards Implemented sub-
attribute.

41. The method of claim 39, wherein said software commonality sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

a number of unique SW packages implemented
sub-attribute;
a number of languages sub-attribute;
a number of compilers sub-attribute;
a average number of SW instantiations sub-
attribute; and
a number of unique standards implemented sub-
attribute.

42. The method of claim 38, wherein said physical familiarity sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

- a percentage vendors known sub-attribute;
- a percentage subcontractors known sub-attribute;
- a percentage HW technology known sub-attribute; and
- a percentage SW technology known sub-attribute.

43. The method of claim 38, wherein said operational commonality sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

- a percentage of operational functions automated sub-attribute;
- a number of unique skill codes required sub-attribute;
- an estimated operational training time - initial sub-attribute;
- an estimated operational training time - refresh from previous system sub-attribute;
- an estimated maintenance training time - initial sub-attribute; and
- an estimated maintenance training time - refresh from previous system sub-attribute.

44. The method of claim 37, wherein said modularity attribute comprises:

a plurality of sub-attributes comprising at least one of:

- a physical modularity sub-attribute;
- a functional modularity sub-attribute;

an orthogonality sub-attribute;

an abstraction sub-attribute; and

an interfaces sub-attribute.

45. The method of claim 44, wherein said physical modularity sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

an ease of system element upgrade sub-attribute; and

an ease of operating system element upgrade sub-attribute.

46. The method of claim 45, wherein said ease of system element upgrade sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

a lines of modified code sub-attribute; and

an amount of labor hours for system rework sub-attribute.

47. The method of claim 45, wherein said ease of operating system element upgrade sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

a lines of modified code sub-attribute; and

an amount of labor hours for system rework sub-attribute.

48. The method of claim 44, wherein said functional modularity sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

an ease of adding new functionality sub-attribute; and

an ease of upgrade existing functionality sub-attribute.

49. The method of claim 48, wherein said ease of adding new functionality sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

a lines of modified code sub-attribute; and

an amount of labor hours for system rework sub-attribute.

50. The method of claim 48, wherein said ease of upgrading existing functionality sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

a lines of modified code sub-attribute; and

an amount of labor hours for system rework sub-attribute.

51. The method of claim 44, wherein said orthogonality sub-attribute comprises:

a plurality of sub-attributes of said orthogonality sub-attribute, said plurality of sub-attributes of said orthogonality sub-attribute comprising at least one of:

a determination of whether functional requirements are

fragmented across multiple processing elements and interfaces

sub-attribute;

a determination of whether there are throughput requirements across interfaces sub-attribute; and

a determination of whether common specifications are identified sub-attribute.

52. The method of claim 44, wherein said abstraction sub-attribute comprises:

a plurality of sub-attributes of said abstraction sub-attribute, said plurality of sub-attributes of said abstraction sub-attribute comprising at least one of:

a determination of whether the system architecture provides an option for information hiding sub-attribute;

53. The method of claim 44, wherein said interfaces sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

a number of unique interfaces per system element sub-attribute;

a number of different networking protocols sub-attribute;

an explicit versus implicit interfaces sub-attribute;

a determination of whether the architecture involves implicit interfaces sub-attribute; and

a number of cables in the system sub-attribute.

54. The method of claim 37, wherein said standards based attribute comprises:

a plurality of sub-attributes comprising at least one of:

an open systems orientation sub-attribute; and

a consistency orientation sub-attribute.

55. The method of claim 54, wherein said open systems orientation sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

an interface standards sub-attribute;

a HW standards sub-attribute; and

a software standards sub-attribute.

56. The method of claim 55, wherein said interface standards sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

a number of interface standards/number and number
of Interfaces sub-attribute;

a determination of multiple vendors (greater than 5)
existing for products based on standards sub-attribute;

a multiple business domains apply/use standard
(Aerospace, Medical, Telecommunications) sub-attribute;

and

a standard maturity sub-attribute.

57. The method of claim 55, wherein said hardware standards sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

a number of form factors and number of LRUs sub-attribute;

a multiple vendors (greater than 5) exist for a products based on standards sub-attribute;

a multiple business domains apply/use standard (aerospace, medical, telecommunications) sub-attribute;

and

a standard maturity sub-attribute.

58. The method of claim 55, wherein said software standards sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

a number of proprietary & unique operating systems sub-attribute;

a number of non-std databases sub-attribute;

a number of proprietary middle-ware sub-attribute;

and

a number of non-std languages sub-attribute.

59. The method of claim 54, wherein said consistency orientation sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

a common guidelines for implementing diagnostics and PM/FL sub-attribute; and

a common guidelines for implementing OMI sub-attribute.

60. The method of claim 37, wherein said RMT attribute comprises:

a plurality of sub-attributes comprising at least one of:

a reliability sub-attribute;

a maintainability sub-attribute; and

a testability sub-attribute.

61. The method of claim 60, wherein said reliability sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

a fault tolerance sub-attribute; and

a critical points of delicateness system loading sub-attribute.

62. The method of claim 61 wherein said fault tolerance sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

a percentage of mission critical functions with single points of failure sub-attribute; and

a percentage of safety critical functions with single points of failure sub-attribute.

63. The method of claim 61 wherein said critical points of delicateness system loading sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

a percentage of processor loading sub-attribute;
a percentage of memory loading sub-attribute; and
a percentage of network loading sub-attribute.

64. The method of claim 63 wherein said percentage memory loading sub-attribute criticality assessment sub-attribute comprises a criticality assessment sub-attribute.

65. The method of claim 63 wherein said percentage network loading sub-attribute comprises a criticality assessment sub-attribute.

66. The method of claim 60, wherein said maintainability sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

an expected mean time to replacement (MTTR) sub-attribute;

a maximum fault group size sub-attribute;

a determination of whether system is operational during maintenance sub-attribute; and

an accessibility sub-attribute.

67. The method of claim 66, wherein said accessibility sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

a space restrictions determination sub-attribute;

a special tool requirements determination
sub-attribute; and
a special skill requirements determination
sub-attribute.

68. The method of claim 60, wherein said testability sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

a BIT Coverage sub-attribute;
an error reproducibility sub-attribute;
an online testing sub-attribute; and
an automated input/stimulation insertion sub-attribute.

69. The method of claim 68 wherein said error reproducibility sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

a logging/recording capability sub-attribute; and
a determination of whether system state at time of
system failure can be created sub-attribute.

70. The method of claim 68 wherein said online testing sub-attribute comprises:

a plurality of sub-attributes comprising at least one of:

a determination of whether system is operational
during external testing sub-attribute; and
an ease of access to external testpoints sub-

attribute.

71. The method of claim 37, wherein said step (a) further comprises:

(3) performing sensitivity analysis of said pair-wise comparisons.

72. A computer program product (CPP) for evaluating system architecture designs using an analytic hierarchy process (AHP) model, said CPP embodied on a computer readable medium having program logic stored therein, comprising:

means for enabling a processor to assign relative weights to each attribute and sub-attribute of a plurality of attributes and sub-attributes of an analytical hierarchy process (AHP) model wherein said plurality of attributes comprises:

a commonality attribute,

a modularity attribute,

a standards based attribute, and

a reliability, maintainability, and testability (RMT) attribute,

comprising:

means for enabling the processor to perform pair-wise comparisons of DOTs said plurality of attributes and sub-attributes at all levels of said AHP model, and

means for enabling the processor to assign relative weights to all of said attributes and sub-attributes at all levels of said AHP model;

means for enabling the processor to generate a GPW for each of a plurality of alternative system architecture designs comprising:

means for enabling the computer to perform pair-wise comparisons of each of said plurality of alternative system architecture designs with respect to said all of said attributes and sub-attributes at all levels of said AHP model; and

means for enabling the computer to evaluate said plurality of alternative system architecture designs from a supportability perspective comprising comparing values of said GPWs of said plurality of alternative system architecture designs.

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